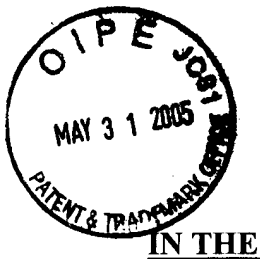


AF
IFW

**PATENT**

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

| | | | |
|---|---|---|---|
| In re the Application of: Frederick C. Dupre, Jr. | | Atty. Docket No.: | 5242.00019 (8230-USA) |
| | | Confirmation No. | 2241 |
| Application No.: | 09/977,245 | GroupArt Unit: | 1711 |
| Filed: | October 16, 2001 | Examiner: | Duc Truong |

For: CURE ACCELERATOR SYSTEM FOR PHENOLIC RESINS

# BRIEF ON APPEAL

**William J. Fisher**
**Registration No. 32,133**

**BANNER & WITCOFF, LTD.**
**1001 G Street, N.W.**
**Washington, D.C. 20001-4597**
**Phone No. 202-824-3000**
**Fax No. 202-824-3001**

## TABLE OF CONTENTS

## TABLE OF AUTHORITIES

**Cases**



**Statutes**

**PATENT**

# IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

| | | | |
|---|---|---|---|
| In re the Application of: Frederick C. Dupre, Jr. | | Atty. Docket No.: | 5242.00019 (8230-USA) |
| Confirmation No. | 2241 | | |
| Application No.: | 09/977,245 | Group Art Unit: | 1711 |
| Filed: | October 16, 2001 | Examiner: | Duc Truong |
| For: | CURE ACCELERATOR SYSTEM FOR PHENOLIC RESINS | | |

## APPEAL BRIEF

U.S. Patent and Trademark Office
Customer Service Window, Mail Stop Appeal Brief - Patents
Randolph Building
401 Dulany Street
Alexandria, VA 22314

Sir:

This is an Appeal Brief in accordance with 37 C.F.R. § 41.37(a) in support of appellants' Notice of Appeal filed March 28, 2005. Appeal is taken from the Final Office Action mailed October 28, 2004, and the Advisory Action mailed March 14, 2005. Please charge any necessary fees in connection with this Appeal Brief to our Deposit Account No. 19-0733.

## REAL PARTY IN INTEREST

37 C.F.R. § 41.37(c)(1)(i)

The real party in interest in this application is Georgia-Pacific Corporation.

## RELATED APPEALS AND INTERFERENCES

37 C.F.R. § 41.37(c)(1)(ii)

There are no related appeals and interferences.

## STATUS OF CLAIMS
37 C.F.R. § 41.37(c)(1)(iii)

Claims 1-9 stand withdrawn. Claims 10-20 stand finally rejected. Claims 10-20 are presented in Appendix 1.

Appellant hereby appeals the rejection of claims 10-20.

## STATUS OF AMENDMENTS
37 C.F.R. § 41.37(c)(1)(iv)

No amendment was filed after final rejection.

## SUMMARY OF CLAIMED SUBJECT MATTER
37 C.F.R. § 41.37(c)(1)(v)

The claims are directed to a curable resin composition for binding wood and wood fiber products (Paragraph [02], page 1) and to cured resin (Example 1, pages 8-11).

Claims 10 and 16 are independent.

As recited in claim 10, the curable resin composition for binding wood and wood fiber products comprises a curable phenol-aldehyde resin, a cyclic carbonate cure accelerant, and amine cure accelerant (paragraph [08]). The curable phenol-aldehyde resin is selected from the group consisting of resole resins and novolac resins comprising a source of free aldehyde. (paragraph [14]). Cyclic carbonate cure accelerant is included in an effective amount (paragraph [21]). Amine cure accelerant is present in an effective amount (paragraph [21]) and is selected from the group consisting of polyalkylene polyamines, polyalkylene glycol polyamines, and blends thereof (paragraph [20]).

Claim 16 is directed to a cured phenol-aldehyde resin for binding wood and wood fiber products (Paragraph [02], Example 1, pages 8-11). The resin is selected from the group

consisting of resole resins and novolac resins comprising a source of free aldehyde (paragraph [14]). The resin is cured in the presence of effective amounts of cyclic carbonate cure accelerant and amine cure accelerant (paragraph [21]) selected from the group consisting of polyalkylene polyamines, polyaklylene glycol polyamines, and blends thereof (paragraph [20]).

## GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

37 C.F.R. § 41.37(c)(1)(vi)

I. Claims 10-20 stand rejected under 35 U.S. C. § 102(b) as anticipated by "Database WPI," hereinafter "Abstract."

II. Claims 12, 13, 18, and 19 stand rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter applicant regards as the invention.

III. Claims 12, 13, 18, and 19 stand rejected under 35 U.S.C. § 112, first paragraph, as not enabling a person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the invention commensurate with the scope of the claims.

## GROUPING OF CLAIMS

The claims stand or fall together with regard to the rejection under 35 U.S.C. § 102(b). Claims 12, 13, 18, and 19 stand or fall together with regard to each rejection under 35 U.S.C. § 112.

## SUMMARY OF ARGUMENT

The anticipation argument ignores key recitations in the rejected claims, misconstrues the law, and impermissibly relies on an allegation of inherency that is contradicted by the reference itself. The indefiniteness rejection is based on an assertion that is contradicted by the

specification. The enablement rejection also is based on an assertion that is contradicted by the specification.

## ARGUMENT

37 C.F.R. § 41.37(c)(1)(vii)

### I. The Abstract Does Not Anticipate the Claimed Invention

The Abstract discloses addition of ethylene carbonate and an alkaline substance to thermosetting resin to harden the resin at room temperature. For the abstract to anticipate applicant's claimed invention, the Abstract must teach ***each and every*** limitation of the claimed invention. *Karsten Mfg. Corp. v. Cleveland Golf Co.,* 242 F.3d 1376, 1383, 58 USPQ2d 1286, 1291 (Fed. Cir. 2001). Because the Abstract does not disclose using polyalkylene polyamines, polyalkylene glycol polyamines, and blends thereof as amine cure accelerant, the Abstract cannot anticipate the claimed invention. Further, because the Abstract does not disclose a resin for binding wood and wood fiber products, the Abstract cannot anticipate the claimed invention inherently.

#### A. The Abstract Does Not Teach Using Polyalkylene Polyamines, Polyalkylene Glycol Polyamines, Or Blends Thereof, as Amine Cure Accelerant

The Abstract discloses use of ethylene carbonate together with "an alkaline substance" to harden a thermosetting resin at room temperature. "Alkaline Substances" include "NaOH, $K_2CO_3$, MgO, $Ca(OH)_2$ amines, etc." Because the Abstract does not disclose using polyalkylene polyamines, polyalkylene glycol polyamines, and blends thereof, the Abstract does not anticipate applicant's claimed invention.

It is well-settled that disclosure of a genus does not by itself render obvious a compound within that genus. *In re Baird*, 16 F.3d 380, 382, 29 USPQ2d 1550, 1552 (Fed. Cir. 1994). ("The

fact that a claimed compound may be encompassed by a disclosed generic formula does not by itself render that compound obvious.") Indeed, even when the prior art discloses a genus and lists several members of the genus, but does not identify the claimed compound, the Federal Circuit has found the claimed compound non-obvious. *In re Jones*, 958 F.2d 347, 350, 21 USPQ2d 1941, 1943 (Fed. Cir. 1992).

Here, the Abstract discloses "amines" as one of many alkaline compounds. The Abstract does not name a single suitable amine. The rejection improperly rejects the claims directed to polyalkylene polyamine and polyalkylene glycol polyamine species as anticipated by the generic disclose of amines.

The disclosure of "amines" includes a large number of compounds. Whereas the polyalkylene polyamine and polyalkylene glycol polyamine species fall within the genus of amines, the Abstract does not suggest the claimed species. Thus, it cannot be said that the Abstract anticipates the claimed invention. *In re Baird*, 16 F.3d at 382, 29 USPQ2d at 1552.

In response to the initial rejection over the Abstract, the claims were amended to recite that the curable resin composition of claim 10 and the cured resin of claim 16 were directed to amine cure accelerants selected from the group consisting of polyalkylene polyamines, polyalkylene glycol polyamines, and blends thereof.

In the Final Rejection, the amendment and related argument were found not to be persuasive because "the polyamines, as amended, are included in the broad teachings of the reference in the use of amines unless Applicant provide [sic] evidence that they are different." (Office Action mailed October 28, 2004, page 2).

To rebut this position taken in the Final Rejection, applicant submitted English-language translations of JP-Sho60/090251 A (Kokai) and JP-Hei07/088460 B (the related Kokoku). The

Abstract relates to the Kokai. These translations, which are in a single document (a copy is in the Evidence Appendix) with differences indicated side-by-side, illustrate that this reference teaches nothing relevant about 'amines.' Rather, the term is merely one entry in a wish-list of basic compounds said to be cure accelerators together with ethylene carbonate. No amine is identified; no amine is exemplified. It was necessary to submit this translation after the Final Rejection to comply with the additional reasoning requiring that Applicant "provide evidence that [the claimed polyamines] are different."

The translation of the underlying Japanese-language document makes clear that nothing relevant to amines and to this invention is disclosed. The document discloses that addition of ethylene carbonate and base to a thermosetting resin containing phenolic hydroxyl moieties effects cure of the resin at room temperature. Suitable bases are identified as those that,

> exhibit[] basicity in water or organic solvent, and this base can be exemplified by the hydroxides and carbonates of alkali metals (e.g., NaOH, $K_2CO_3$, etc.), the oxides and hydroxides of alkaline-earth metals (e.g., MgO, $Ca(OH)_2$, etc.), and organic bases such as amines, etc.

This disclosure teaches nothing regarding particular amines, and neither suggests nor discloses the claimed invention.

The translation contains exemplification of curing systems. The basic compounds used in the examples are NaOH, $Ca(OH)_2$, MgO, primary sodium phosphate, and boric acid. Of nine examples, not one uses an amine, thus confirming that this document contains nothing relevant about the polyamines recited in the pending claims.

The translation is devoid of a disclosure of even a single amine that would be suitable. Whereas specific alkali metal carbonates and hydroxides are identified and specific alkaline earth

metal oxides and hydroxides are identified, not a single amine is identified. Therefore, this document discloses nothing but the genus amines, and does not disclose (or suggest) the polyamines claimed in this invention.

The rejection of claims 10-20 as anticipated by the Abstract must be reversed.

**B. The Abstract Does Not Inherently Disclose A Curable or Cured Resin For Binding Wood and Wood Fiber Products**

The claims were amended to include the recitation "for binding wood and wood fiber products" in response to the first office action. In the Final Rejection, no comment was made about this limitation. The rejection over the Abstract continued to be based solely on the "amine" issue.

However, an issue of inherency was raised for the first time in the Advisory Action. The communication dated March 14, 2005, states the following at page 2:

> Note that the reference [the Abstract] does disclose the requirement of claim 10, as stated in the last office action, then the use "for binding wood and wood fiber products["] must be inherent in the prior art.

As set forth in sub-section A of this section, the Abstract does not disclose the requirement of claim 10. Further, the claimed use, for binding wood and wood fiber products, is not disclosed, explicitly or inherently, in the Abstract.

"A reference includes an inherent characteristic if that characteristic is the 'natural result' flowing from the reference's explicitly explicated limitations." *Eli Lilly & Co. v. Barr Laboratories, Inc.*, 2001 WL 766766, 58 USPQ2d 1869, 1880 (Fed. Cir. 2001), citing *Continental Can Company USA, Inc. v. Monsanto Co.*, 948 F.2d 1264, 1268, 20 USPQ2d 1746,

1749 (Fed.Cir. 1991) (references omitted). The allegedly inherent characteristic of "bonding wood and wood fiber products" **is not** a natural result of the disclosure of the Abstract.

The skilled practitioner would recognize this disclosure as teaching that amines are an alkaline substance no different from $K_2CO_3$, MgO, or $Ca(OH)_2$. Skilled practitioners recognize that solids such as MgO are not suitably used for binding wood and wood fiber products because they are not soluble in the resin. Insolubility of MgO is described in *Gerber*, U.S. Patent Number 5,294,649, column 4, lines 11-15, as it relates to binders for aggregate materials. (The Gerber document was made of record in the Information Disclosure Statement filed March 11, 2003, and was relied upon by the Examiner in the first Office Action. A copy can be found in the Evidence Appendix.) Further, the Abstract notes that rights to the subject matter in the Abstract are assigned to Kyushu Refractory Co. Ltd. Although this fact is at least anecdotal evidence, it suggests to the skilled practitioner that the resins disclosed are casting resins for refractory or other aggregates, not for binding wood and wood fiber products. Further, the ranges of additives are so broad as to be meaningless, and admit of having four parts of additives to one part of resin.

It is well-settled that:

> [t]o serve as an anticipation when the reference is silent about the asserted inherent characteristic, such gap in the reference may be filled with recourse to extrinsic evidence. Such evidence must make it clear that the missing descriptive matter is necessarily present in the thing described in the reference, and that it would be so recognized by persons of ordinary skill.

*Continental Can USA, Inc. v. Monsanto Co.*, 948 F.2d 1264, 1268, 20 USPQ2d 1746, 1749 (Fed. Cir. 1991). Indeed, the Examiner has improperly asserted the inherency argument without any information about why the skilled practitioner would find the allegedly inherent disclosure in the

otherwise silent document. Here, the Abstract does not refer to or identify the use "for binding wood and wood fiber products." In the face of this obvious lack, the Examiner has made no appropriate showing. In any event, there was already in the evidence of record information refuting the Examiner's position. This evidence also is relevant to the point that skilled practitioners would not recognize the claimed invention in the Abstract.

The English-language translation of the *Kokai* underlying the Abstract illustrates that the use "for binding wood and wood fiber products" is not inherent in the disclosure. The translation was of record during the prosecution, and thus was available to the Examiner when the inherency argument relating to the Abstract was raised in the Advisory Action. However, out of an abundance of caution, Applicant notes that the use of this translation as extrinsic evidence to rebut the inherency argument made for the first time in the Advisory Action provides good and sufficient reason for submitting this evidence at this time.

The translation makes it clear that the resins disclosed therein are for casting and molding. The translation makes it clear that the Abstract does not inherently disclose binding of wood and wood fiber products.

The resins contemplated are for "molding material." Importantly, as was true for the resins disclosed in *Gerber*, these resins are for casting such as is done with refractory, and not to bind wood and wood fibers as disclosed and claimed in the pending application. First, as the skilled practitioner recognizes, MgO typically is not soluble in such resins, and leaves particulate matter that is deleterious to resins of the type claimed in the subject invention. Indeed, as set forth in the Kokoku, at page 6 of the translation, some of the bases, including MgO, are in microparticulate form. Skilled practitioners recognize that undissolved solids are not acceptable in a resin to be used to bind wood and wood fiber products.

Second, all of the examples are molding/casting material expected to exhibit compressive strength. Examples 1-5 record the cure time required for molded resin to reach a specified compressive strength. Examples 6-9 are directed to casting resins having equal parts of resin and calcium carbonate filler. Again, the cure time required for cast resin to reach a specified compressive strength is recorded. Thus, Applicant respectfully submits that this document is not relevant to the claimed invention, and that the claims are in condition for allowance.

Thus, it is clear that use "for binding wood and wood fiber products" is not inherently disclosed in the Abstract. The rejection of claims 10-20 as inherently anticipated by the Abstract must be reversed.

## II. Claims 12, 13, 18 and 19 Particularly Point Out and Distinctly Claim the Subject Matter Applicant Regards as the Invention

### A. Triethylene Triamine, Triethylene Tetramine, Tetraethylene Tetramine, and Tetraethylene Pentamine are Identified in the Specification as Polyalkylene Polyamine Amine Cure Accelerants

Claims 12, 13, 18, and 19 contain the phrase "wherein the polyalkylene polyamine amine cure accelerant is selected from the group consisting of triethylene triamine, triethylene tetramine, tetraethylene tetramine, tetraethylene pentamine, and blends thereof." This is said to be indefinite "in that the triethylene triamine, triethylene tetramine, tetraethylene tetramine, tetraethylene pentamine are not included in the polyalkylene polyamine amine component." (Final Rejection, page 2).

The rejection is not well founded. The specification, which contains the following statement at paragraph [20], lines 3-5, cannot be more clear:

> Preferred polyalkylene polyamines include triethylene triamine, triethylene tetramine, tetraethylene tetramine, and tetraethylene pentamine.

Thus, the rejection of claims 12, 13, 18, and 19 for this reason under 35 U.S.C. § 112, second paragraph, must be reversed.

**B. The Phrase "Polyalkylene Glycol Polyamines, and Blends Thereof," Is Not Indefinite**

The reasoning said to support the indefiniteness rejection was supplemented by the following argument made for the first time in the advisory action:

> Further, claim 12 is also indefinite in its use of 'the polyalkylene glycol polyamine amine cure accelerant is [sic] selected from the group consisting of polyethyleneglycol diamines, and blends thereof' in that the claim does not disclose a second amine cure accelerant to be blended with the polyethyleneglycol diamines.

Although this ground of rejection was not applied to claims 13, 18, and 19, these claims also contain the language identified.

The phrase "selected from the group consisting of polyethylene glycol diamines, and blends thereof," is not indefinite. As set forth in the specification, polyethylene glycol diamines are a preferred class of polyalkylene glycol polyamines. Paragraph [20], lines 5-8. There is more than one such polyamine; triethylene glycol diamine and tetraethylene glycol diamine are two diamines identified in the specification. *Id.* Therefore, blends of these diamines are possible.

Thus, the claims are clearly directed to curable compositions (claims 12 and 13) or cured resins (claims 18 and 19) for which the polyalkylene glycol polyamine amine cure accelerant can be one or a blend of the polyalkylene glycol diamines.

The rejection on this basis of claim 12 (and of identically-worded claims 13, 18, and 19) as indefinite under 35 U.S.C. § 112, second paragraph, must be reversed.

## III. Claims 12, 13, 18 and 19 are Enabled For Polyalkylene Polyamine Amine Cure Accelerant

In the Final Rejection, claims 12, 13, 18 and 19 were rejected under 35 U.S.C. § 112, first paragraph,

> because the specification, while being enabling for polyalkylene polyamines and polyalkylene glycol polyamines as amine cure accelerant, does not reasonably provide enablement for polyalkylene polyamine amine cure accelerant.

This rejection is self-contradictory. Because the specification is enabling for polyalkylene polyamines as amine cure accelerant, enablement must be provided for polyakylene polyamine amine cure accelerants.

Paragraph [20] of the specification clearly discloses that polyalkylene polyamines are preferred amine cure accelerant. Example 1 sets forth many examples using polyalkylene polyamines as amine cure accelerant.

The phrase "amine cure accelerant" is used in paragraphs [18], [20], and [21], and elsewhere in the specification, and in claims 10, 12, 13, 16, 18, 19, and 20 to identify this class of accelerants. Similarly, the phrase "cyclic carbonate cure accelerant" is used, not only at paragraphs [18], [19], and [21] and elsewhere in the specification, but also in claims 10, 11, 16, and 17, and 20 for the other class of accelerant used in the claimed invention.

The rationale for this rejection, "[t]he use of the term 'polyakylene polyamine amine cure accelerant' as amended raise [sic] the problems [sic] in that it does not determine what are the difference [sic] between the polyamino group and the amino group," suggests that the phrase "polyalkylene polyamine amine cure accelerant" was misunderstood. There is no "amino" group separate from the "polyamino" moieties. As can be seen, this phrase is appropriately used and does not give rise to an enablement rejection.

The phrase identifies one type of amine cure accelerant, just as the phrase "polyalkylene glycol polyamine amine cure accelerant" identifies another. As set forth in the first part of the rejection, the specification is enabling for both polyalkylene polyamines and polyalkynene glycol polyamines as amine cure accelerants.

The rejection on this basis under 35 U.S.C. § 112, first paragraph, of claims 12, 13, 18, and 19 must be reversed.

## CONCLUSION

When the claimed invention is considered and the references properly construed, there is nothing supporting the anticipation rejection set forth in the Final Rejection and supplemented in the advisory action. There is no basis for finding claims 10-20 anticipated over the Abstract.

Further, claims 12, 13, 18, and 19 particularly point out and distinctly claim the subject matter applicant regards as the invention. Also, claims 12, 13, 18, and 19 are enabled by the specification. There is no basis for rejecting these claims under 35 U.S.C. § 112, second or first paragraph.

For the reasons set forth herein, the rejection of claims 10-20 as anticipated under 35 U.S.C. § 102(b) and the rejections of claims 12, 13, 18, and 19 under 35 U.S.C. § 112, first and second paragraphs, are improper. The Board of Patent Appeals and Interferences should reverse these rejections.

Respectfully submitted,

Date: May 31, 2005

By: William J. Fisher
William J. Fisher
Registration No. 32,133

BANNER & WITCOFF, LTD.
1001 G Street, N.W.
Washington, D.C. 20001-4597
Tel: (202) 824-3000
Fax: (202) 824-3001

893501-1
WJF/bao

## CLAIMS APPENDIX
37 C.F.R. § 41.37(c)(1)(viii)

Claim 10 A curable resin composition for binding wood and wood fiber products, said composition comprising:

a curable phenol-aldehyde resin selected from the group consisting of resole resins and novolac resins comprising a source of free aldehyde;

an effective amount of cyclic carbonate cure accelerant; and

an effective amount of amine cure accelerant selected from the group consisting of polyalkylene polyamines, polyalkylene glycol polyamines, and blends thereof.

Claim 11 The composition of claim 10 wherein the cyclic carbonate cure accelerant is selected from the group consisting of alkylene carbonate, ethylene glycol carbonate; glycerol carbonate; glycidol carbonate; 1, 2-butanediol carbonate; 1, 3-butanediol carbonate; 1, 2-pentanediol carbonate; 1, 3-pentanediol carbonate; epoxy carbonates; and blends thereof, and is present in an amount between about 0.1 and about 20 weight%, based on the weight of the resin.

Claim 12 The resin composition of claim 10 wherein the polyalkylene polyamine amine cure accelerant is selected from the group consisting of triethylene triamine, triethylene tetramine, tetraethylene tetramine, tetraethylene pentamine, and blends thereof, the polyalkylene glycol polyamine amine cure accelerant is selected from the group consisting of polyethyleneglycol diamines, and blends thereof, and is present in an amount between 0.1 and about 10 weight %, based on the weight of the resin.

Claim 13 The resin composition of claim 11 wherein the polyalkylene polyamine amine cure accelerant is selected from the group consisting of triethylene triamine, triethylene tetramine, tetraethylene tetramine, tetraethylene pentamine, and blends thereof, the polyalkylene glycol polyamine amine cure accelerant is selected from the group consisting of polyethyleneglycol diamines, and blends thereof, and is present in an amount between 0.1 and about 10 weight %, based on the weight of the resin.

Claim 14 The resin composition of claim 13 further comprising an effective amount of resorcinol source.

Claim 15 The resin composition of claim 14, wherein the resorcinol source is a formaldehyde-starved novolac resorcinol-formaldehyde resin and is present in an amount sufficient to provide resorcinol in an amount between about 0.1 and about 30 weight%, based on the weight of the resin.

Claim 16 A cured phenol-aldehyde resin for binding wood and wood fiber products, said resin selected from the group consisting of resole resins and novolac resins comprising a source of free aldehyde, wherein said resin is cured in the presence of effective amounts of cyclic carbonate cure accelerant and amine cure accelerant selected from the group consisting of polyalkylene polyamines, polyalkylene glycol polyamines, and blends thereof.

Claim 17 The resin of claim 16 wherein the cyclic carbonate cure accelerant is selected from the group consisting of alkylene carbonate, ethylene glycol carbonate; glycerol carbonate; glycidol carbonate; 1, 2-butanediol carbonate; 1, 3-butanediol carbonate; 1, 2-

pentanediol carbonate; 1, 3-pentanediol carbonate; epoxy carbonates; and blends thereof, and is present in an amount between about 0.1 and about 20 weight%, based on the weight of the resin.

Claim 18 The resin of claim 16 wherein the polyalkylene polyamine amine cure accelerant is selected from the group consisting of triethylene triamine, triethylene tetramine, tetraethylene tetramine, tetraethylene pentamine, and blends thereof, the polyalkylene glycol polyamine amine cure accelerant is selected from the group consisting of polyethyleneglycol diamines, and blends thereof, and is present in an amount between 0.1 and about 10 weight %, based on the weight of the resin.

Claim 19 The resin of claim 17 wherein the polyalkylene polyamine amine cure accelerant is selected from the group consisting of triethylene triamine, triethylene tetramine, tetraethylene tetramine, tetraethylene pentamine, and blends thereof, the polyalkylene glycol polyamine amine cure accelerant is selected from the group consisting of polyethyleneglycol diamines, and blends thereof, and is present in an amount between 0.1 and about 10 weight %, based on the weight of the resin.

Claim 20 The resin of claim 16, wherein said resin is cured in the presence of effective amounts of cyclic carbonate cure accelerant, amine cure accelerant, and resorcinol source.

## EVIDENCE APPENDIX

37 C.F.R. § 41.37(c)(1)(ix)

1. Translation of JP Sho 60-090251 and Hei 07-088460 (Kyushu Refractory Co., Ltd.)

This document was submitted in response to additional reasoning first set forth in the Final Rejection. This document also is submitted as extrinsic evidence to rebut the inherency issue first raised in the Advisory Action.

2. Gerber, United States Patent No. 5,294,649

This document was submitted with the Information Disclosure Statement filed March 11, 2003, and was relied upon in the first Office Action.

## RELATED PROCEEDINGS APPENDIX

37 C.F.R. § 41.37(c)(1)(x)

None.

# English-language Translation of

# JP Sho 60/090251 A (Kokai)

# and JP Hei 07/088460 B (Kokoku)

Relating to the document identified as "Database WPI"
(The "Abstract")

# SPECIFICATION

## 1. Title of the Invention

Method for the ambient temperature curing of thermosetting resins

## 2. Claim

Claim 1.

| Version from Japanese Laid Open (Unexamined or Kokai or A) Patent Application Number Sho 60-090251 (the A document) | Version from Japanese Published (Examined or Kokoku or B) Patent Application Number Hei 07-088460 (the B document) |
|---|---|
| Method for the ambient temperature curing of thermosetting resins, characterized in that curing is effected at ambient temperature by means of the addition of ethylene carbonate and base to thermosetting resin. | Method for the ambient temperature curing of thermosetting resins, characterized in that curing is effected at ambient temperature by means of the addition of ethylene carbonate and base to thermosetting resin that contains phenolic OH. |

## 3. Detailed Description of the Invention

The invention relates to a method for the ambient temperature curing of thermosetting resins. More particularly, the invention relates to a method for the ambient temperature curing of thermosetting resins, wherein said method enables free control of the cure rate, is easy to carry out, and has a broad range of application.

Thermosetting resins cure by the application of heat, as the name implies, and are in wide use. However, the cure of thermosetting resins at or near ambient temperature has recently come under investigation in support of efforts at energy conservation and in order to enable application with materials that cannot be heated.

The acid curing method is the most widely known ambient temperature curing method. Acid curing is a method in which the resin is polymerized and crosslinked using an acid such as p-toluenesulfonic acid. The cure rate can be adjusted in the acid curing method by adjusting the type and amount of acid that is added. However, since this method employs acid, when a basic substance is used for the backbone substance, reaction between the acid and basic substance proceeds preferentially and an inadequate cure is produced. Moreover, acid curing cannot be used to cure structures in contact with metal due to the corrosiveness exercised by the acid. Another problem is that acid-cured resins generally have a low impact strength and are brittle. Acid curing also requires the use of large amounts of strong acid to raise the cure rate, and the curing reaction, once started, proceeds with increasing velocity since acid-induced curing reactions are accompanied by the generation of large amounts of heat. This facilitates the generation of pores in the cured product and in some cases is also hazardous. These factors place limits on the extent to which the cure rate can be raised.

The isocyanate curing method, which has reached the level of practical application, improves upon the problems identified above. Isocyanate curing uses an isocyanate as the curing agent and uses a tertiary amine as a cure accelerator. While the isocyanate curing method is an excellent curing method, it yields a cured product that contains the urethane bond, which forfeits the excellent heat resistance that is an advantage of thermosetting resins. In addition, the tertiary amine cure accelerator (e.g., triethylenediamine, N-alkylformalin) is frequently toxic and must be handled in a sealed system. Moreover, when used with a mold, the evolution of cyanide has been reported due to thermal degradation of the isocyanate curing agent. Thus, the isocyanate curing method also cannot be said to be entirely satisfactory.

| Version from the A document | Version from the B document |
|---|---|
| This invention was achieved as a result of various investigations, taking into account the circumstances noted above, into the ambient temperature curability of thermosetting resins. The object of this invention is to provide a method for the ambient temperature curing of thermosetting resins, wherein said method does not require special handling equipment and enables free control of the cure rate. | This invention was achieved as a result of various investigations, taking into account the circumstances noted above, into the ambient temperature curability of thermosetting resins and particularly thermosetting resins bearing phenolic OH, such as the widely used phenolic resins. The object of this invention is to provide a method for the ambient temperature curing of thermosetting resins bearing phenolic OH, wherein said method does not require special handling equipment and enables free control of the cure rate. |

The inventive method, through its use of ethylene carbonate as the curing agent for thermosetting resin and the addition of base as a cure accelerator, achieves the ambient temperature cure of thermosetting resin and makes possible free control of the cure rate.

Version from the A document

The most significant advantage of the ethylene carbonate curing agent used by this invention is that it makes possible an extremely broad-ranging control of the cure time — from approximately 1 minute at the shortest to 24 hours or more — through selection of the type and quantity of addition of the base used as cure accelerator. In addition, unlike the circumstances with acid curing, a sharp exothermic reaction is not encountered even when curing is carried out very rapidly in a brief 1-2 minutes.

Version from the B document

The most significant advantage of the ethylene carbonate curing agent used by this invention is that it makes possible an extremely broad-ranging control of the cure time at around ambient temperature — from approximately 1 minute at the shortest to 24 hours or more — based on selection of the type and quantity of addition of the base used as cure accelerator. In addition, unlike the circumstances with acid curing, a sharp exothermic reaction is not encountered even when curing is carried out very rapidly in a brief 1-2 minutes.

Version from the A document

It is believed that ring-opening of the ethylene carbonate curing agent is promoted by the action of the base used as cure accelerator and that curing at ambient temperature proceeds through the reaction of the ring-opened ethylene carbonate with the thermosetting resin, resulting in polymerization and crosslinking.

Version from the B document

It is believed that the base used as cure accelerator acts even at ambient temperature to promote ring-opening of the ethylene carbonate curing agent through elimination of the carbonate group and that curing at ambient temperature proceeds through reaction of the ring-opened ethylene group with terminal methylol and hydrogen on benzene activated by the effect of the OH group in the phenolic OH-bearing thermosetting resin, resulting in polymerization and crosslinking.

Version from the A document

The thermosetting resin used by the invention can be exemplified by phenolic resins, furan resins, urea resins, melamine resins, and so forth, among which resole-type phenolic resins, furan resins, and modified resins therefrom are preferred.

Version from the B document

The phenolic OH-bearing thermosetting resin used by the invention can be exemplified by phenolic resins, furan resins, and modified resins therefrom, among which phenolic resins are preferred.

Version from the A document

Ethylene carbonate is used as the inventive curing agent. It is added at 1-100 weight parts and preferably 2-80 weight parts per 100 weight parts thermosetting resin. Thorough development of the curing reaction is not obtained at an ethylene carbonate addition of less than 1 weight part, and as a result the obtained cured product will not exhibit satisfactory strength. The addition of more than 100 weight parts is undesirable for the following reasons: the cure is unchanged at additions greater than 100 weight parts, making such additions uneconomical; also, the ethylene carbonate that does not participate in the curing reaction will function as a solvent, resulting in a porous cured product that exhibits poor strength.

Version from the B document

Ethylene carbonate is used as the inventive curing agent. It is added at 1-100 weight parts and preferably 2-80 weight parts per 100 weight parts of the phenolic OH-bearing thermosetting resin. Thorough development of the curing reaction is not obtained at an ethylene carbonate addition of less than 1 weight part, and as a result the obtained cured product will not exhibit satisfactory strength. The addition of more than 100 weight parts is undesirable for the following reasons: the cure is unchanged at additions greater than 100 weight parts, making such additions uneconomical; also, the ethylene carbonate that does not participate in the curing reaction will function as a solvent, resulting in a porous cured product that exhibits poor strength.

There are no restrictions on the base used as the cure accelerator as long as it exhibits basicity in water or organic solvent, and this base can be exemplified by the hydroxides and carbonates of alkali metals (e.g., NaOH, $K_2CO_3$, etc.), the oxides and hydroxides of alkaline-earth metals (e.g., MgO, $Ca(OH)_2$, etc.), and organic bases such as amines, etc. The use of a strong base results in a high cure rate, while the use of a weak base results in gentle cure development. The type and quantity of addition of the base may therefore be selected based on the required cure rate. While the quantity of base addition is determined in light of the type selected based on the desired cure rate as discussed above, the use of 3-300 weight parts per

100 weight parts ethylene carbonate is desirable. Lower additions in the range of 3-150 weight parts are appropriate for strong bases, while larger additions in the range of 30-300 weight parts are appropriate for weak bases. Resole-type phenolic resins are produced by the base-catalyzed reaction of phenol and formaldehyde followed by neutralization by the addition of acid. Ambient temperature curing can also be achieved without the specific addition of base through the direct use of resole-type phenol resin that has not been subjected to acid neutralization. The cure rate can be controlled even in this case by promoting cure by the further addition of base or by inhibiting cure by a less-than-exhaustive addition of acid.

| Version from the A document | Version from the B document |
|---|---|
| The A document does not contain a corresponding paragraph. | When, for example, magnesium [sic] or calcia is present in microparticulate form in the material to be cured, for example, molding material, use of the base compound may be omitted. However, in the event of a slow cure rate, the base compound may be added in order to adjust the rate. |

| Version from the A document | Version from the B document |
|---|---|
| A characteristic feature of the inventive method for curing thermosetting resin is the use of ethylene carbonate as curing agent and base as cure accelerator in order to bring about ambient temperature curing. However, it is also possible to carry out curing at temperatures above ambient temperature. | A characteristic feature of the inventive method for curing phenolic OH-bearing thermosetting resin is the use of ethylene carbonate as curing agent and base as cure accelerator in order to bring about ambient temperature curing. However, it is also possible to carry out curing at temperatures above ambient temperature. |

| Version from the A document | Version from the B document |
|---|---|
| The content of the invention is described below using examples, but the inventive method for the ambient temperature curing of thermosetting resin is not limited by these examples. | The content of the invention is described below using examples, but the inventive method for the ambient temperature curing of phenolic OH-bearing thermosetting resin is not limited by these examples. |

## Examples 1-5

Curing tests at ambient temperature (18°C) were carried out by the combination of resole-type phenolic resin (specific gravity = 1.19, 59% nonvolatile fraction, viscosity = 85 cP at 25°C, pH = 7.1), ethylene carbonate, and base in the amounts reported in Table 1 with 100 weight parts silica. The tests were carried out by mixing/kneading the blend using a Waring mixer, molding immediately after dust discharge to 50 × 50 × 50 mm, and curing after molding. The time required to reach a compressive strength of 20 kg/cm$^2$ was measured and designated the cure time. The results are reported in Table 1.

Table 1.

| example no. | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| addition in weight parts | | | | | |
| phenolic resin | 2 | 2 | 2 | 2 | 2 |
| ethylene carbonate | 0.5 | 1 | 1 | 1.6 | 1 |
| base | 50% aq. NaOH solution<br>1 | 50% aq. NaOH solution<br>0.2 | $Ca(OH)_2$<br>1 | MgO<br>1 | MgO<br>0.5 |
| cure time | 1.5 min | 10 min | 1.5 hr | 5 hr | 24 hr |

As shown in the preceding examples, the inventive curing method enables a thorough cure at ambient temperature and also makes it possible to adjust the cure time over a very broad range.

## Examples 6-9

Casting was carried out at ambient temperature after the combination of unneutralized resole-type phenolic resin (specific gravity = 1.16, nonvolatile fraction = 42%, viscosity = 95 cP at 25°C, pH = 11.4) with 100 parts calcium carbonate filler. The additives other than calcium carbonate and their quantities of addition are reported in Table 2. After the blend had been mixed/kneaded with a kneader, it was poured into a 50 Ø × 50 H mm shape. The cure time was the time required to reach a compressive strength of 20 kg/cm$^2$ and is reported in Table 2.

Table 2.

| example no. | 6 | 7 | 8 | 9 |
|---|---|---|---|---|
| addition in weight parts | | | | |
| phenolic resin | 40 | 40 | 40 | 40 |
| ethylene carbonate | 2 | 2 | 2 | 2 |
| cure-adjustment agent | 50% aq. NaOH solution 0.6 | — | primary sodium phosphate 0.6 | boric acid 1 |
| cure time | 20 min | 50 min | 5 hr | 12 hr |

As the preceding examples make clear, the inventive curing method is entirely practical even when the thermosetting resin is used as a casting material and still enables control of the cure rate.